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Die folgenden Angaben sind den vom Anmelder eingereichten Unterlagen entnommen

Prüfungsantrag gem. § 44 PatG ist gestellt

(54) Stoßdämpfer für ein Fahrzeug, das plastische Verformungen ausnutzt

(57) Der Stoßdämpfer ist zwischen einem Puffer und dem Rahmen eines Fahrzeugs montiert, um auf den Puffer oder Stoßdämpfer ausgeübte Impaktenergie in Verformungsenergie umzuformen. Der Absorber oder Stoßdämpfer umfasst ein gerades Rohr, das sich plastisch verformen lässt. Ein gerades Rohr wird teilweise vergrößert oder aufgeweitet oder teilweise reduziert, um unterschiedliche Durchmesserteile zu bilden. Diese Rohrteile sind durch Stufen verbunden, die zwischen dem Rand einer jeden geformt sind. So wird ein Mehrfachdurchmesserrohr mit Stufen gebildet. Die an beiden Enden des Stufenrohrs mit Mehrfachdurchmesser positionierten Rohre sind mit dem Puffer oder Stoßdämpfer bzw. dem Rahmen des Fahrzeugs verbunden.

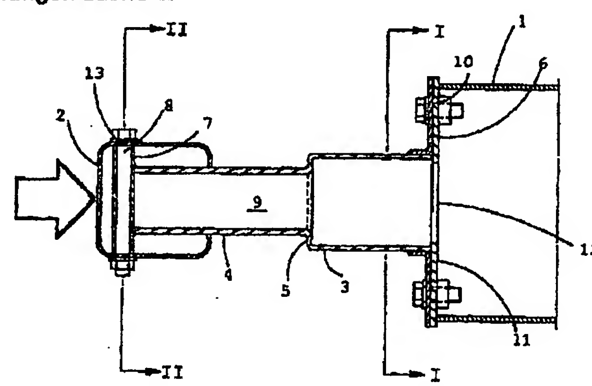

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Fig.1

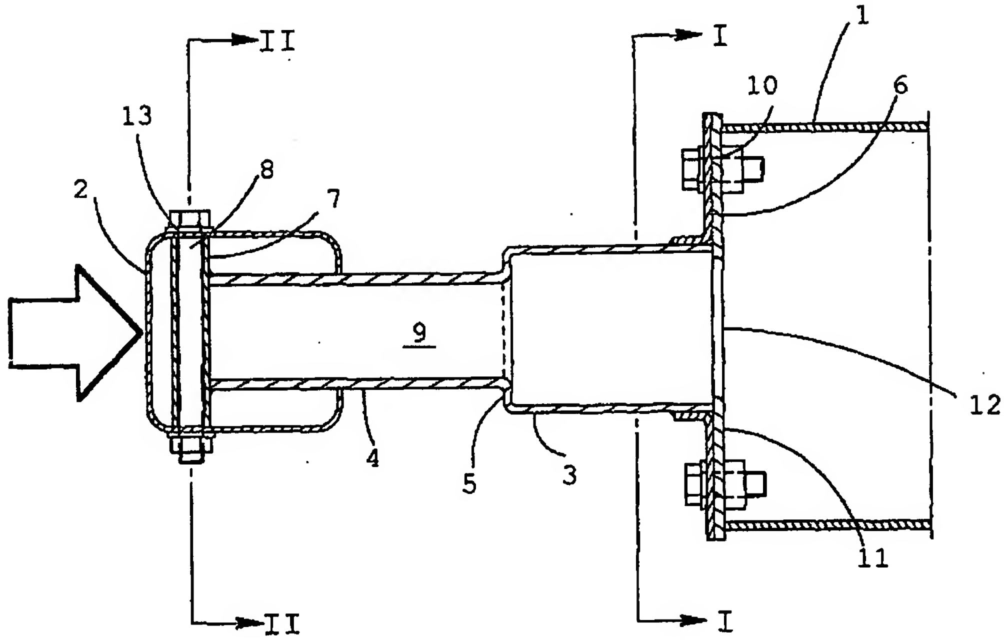

Fig.2

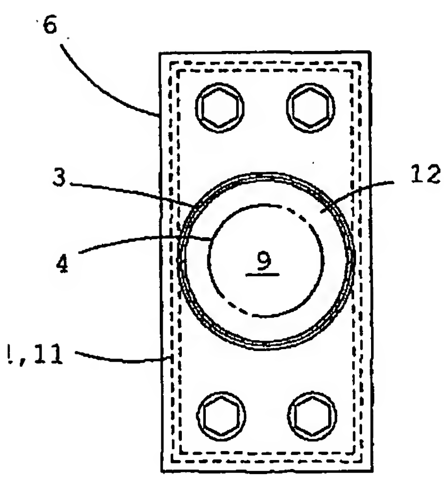

Fig.3

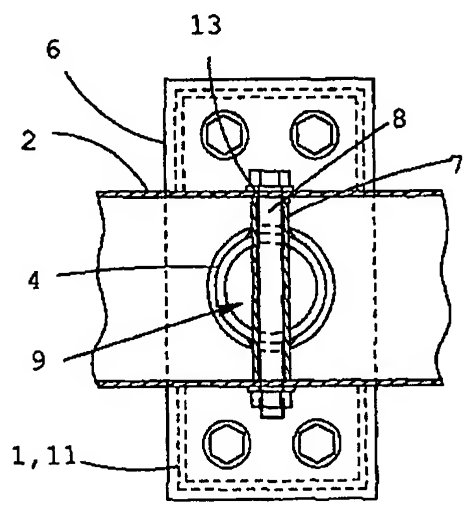

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Fig.4

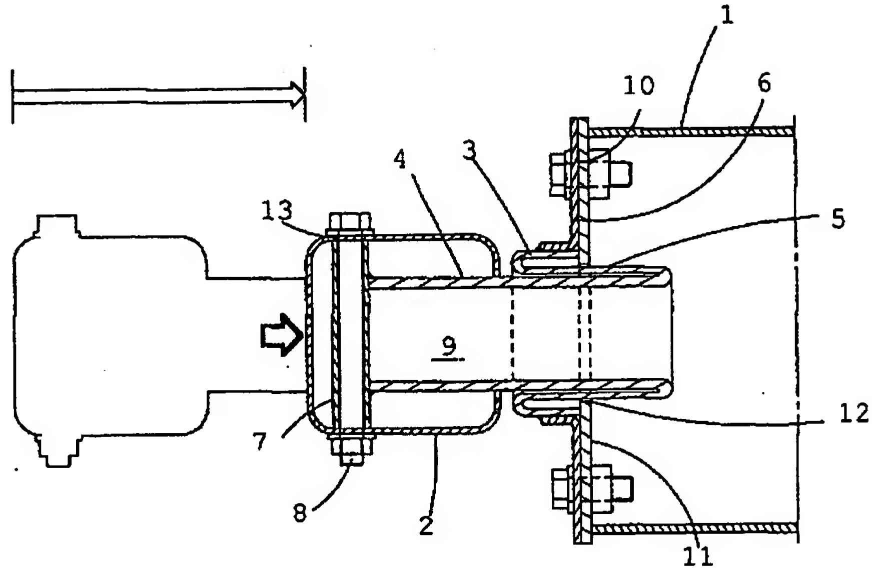

Fig.5

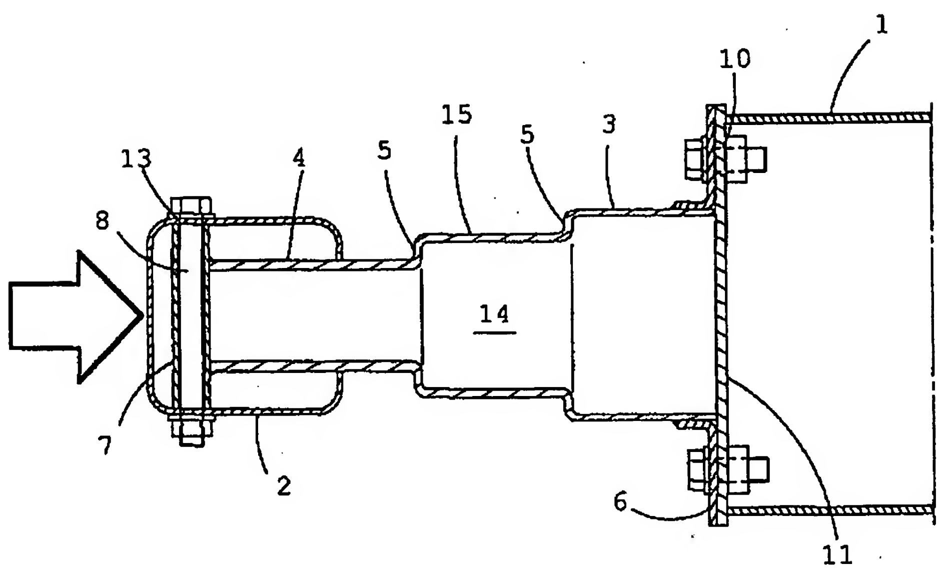

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Fig.6

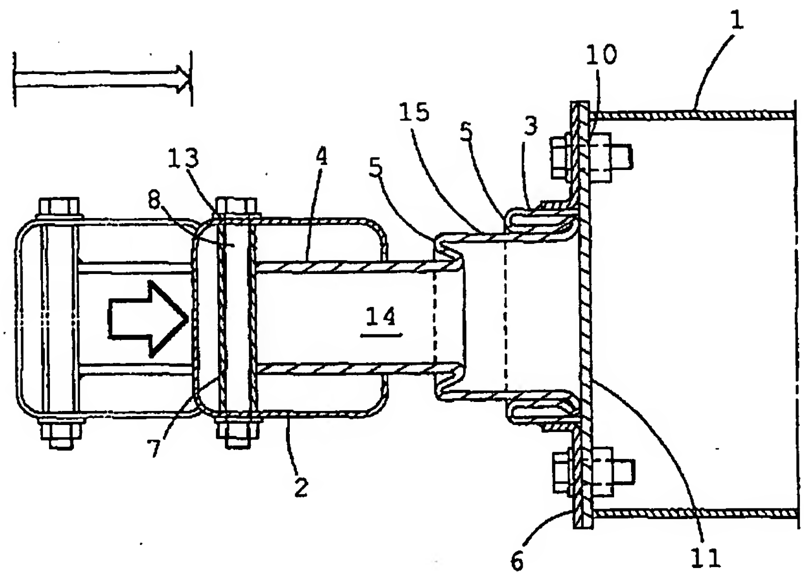
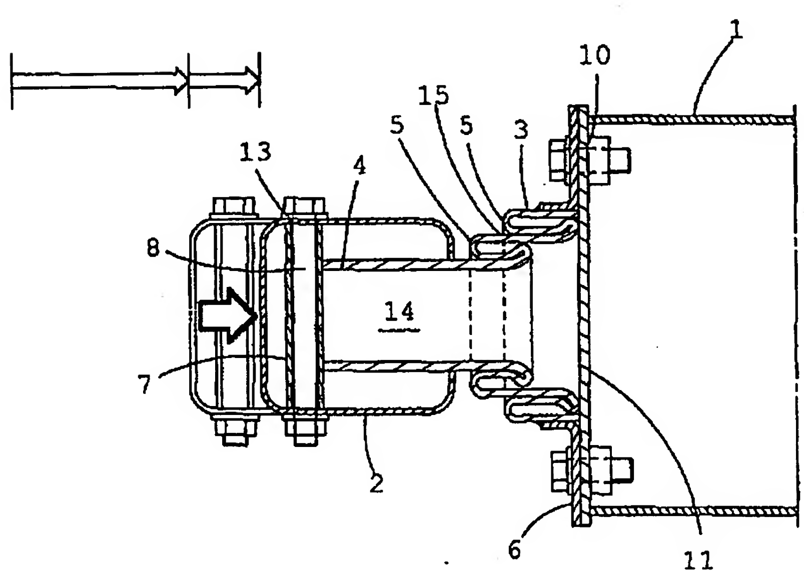


Fig.7



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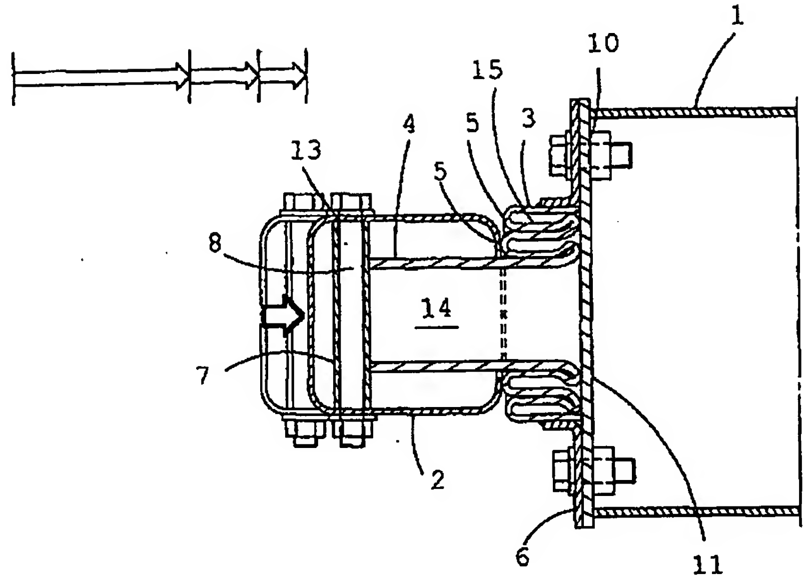

Fig.9

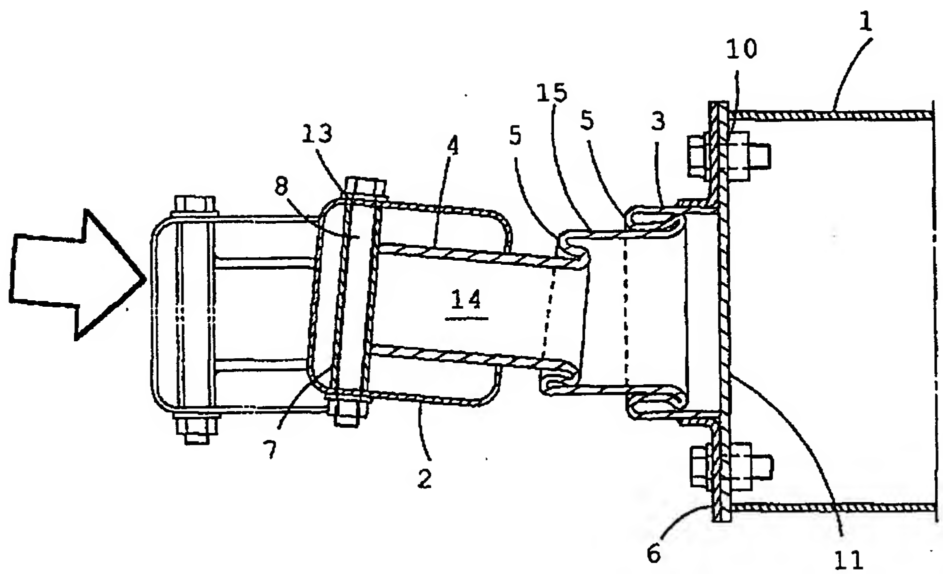

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Fig.10

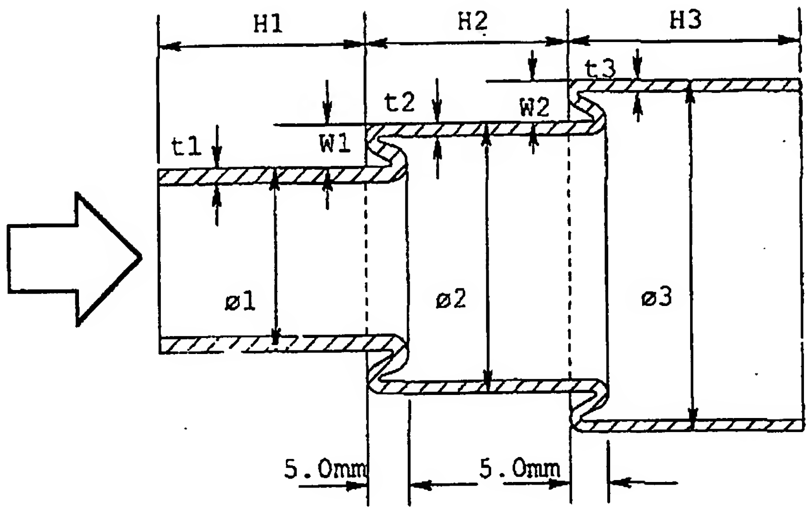
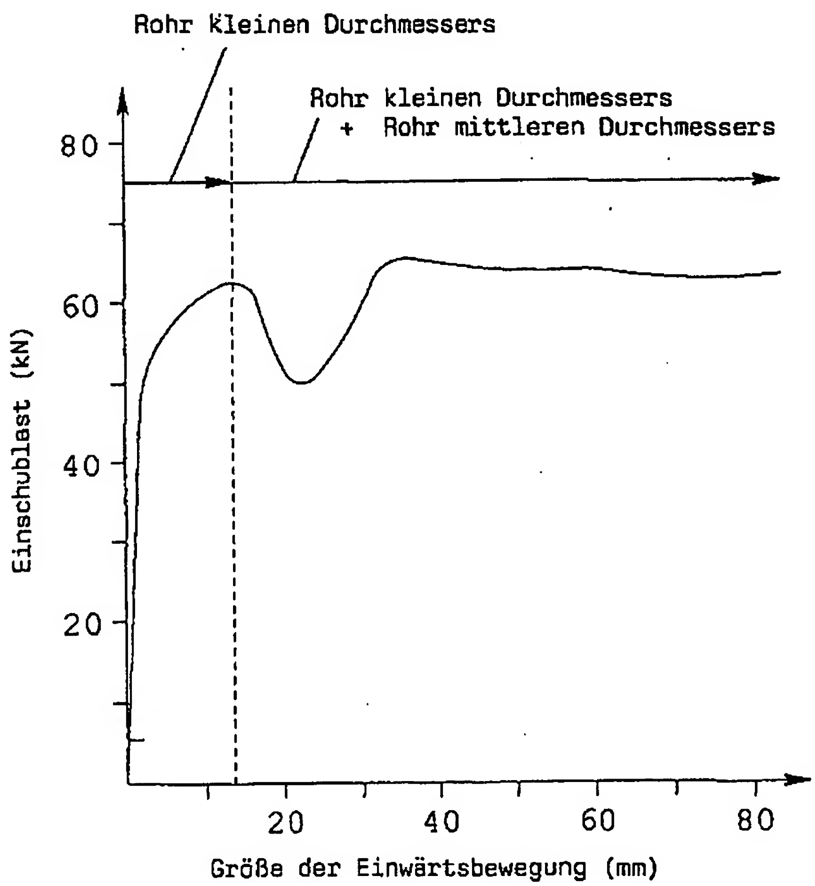


Fig.11



BACKGROUND OF THE INVENTION

1. Area of the invention

The available invention concerns shock absorbers, which are installed between a bumper and a framework of a vehicle, in order impact energy, which on the bumper or buffers is exercised, into deformation energy to transform and thereby the energy to absorb.

2. Description of the state of the art

Usual shock absorbers cover such by the cylinder type, like them are described in US HP NR. 4,537,734 as well as of the type, with which a plastic deformation is used such as dents or breaks. With the cylinder type impact energy is absorbed as energy, which compresses a cylinder. The latter type is described in the Japanese revealed patent application NR. 086309/1997 and with that impact energy is converted into deformation energy of an element, whereby the energy is absorbed. This cylinder type has the advantage that the energy absorbing characteristics are stable. This construction however requires precision and many construction units. It therefore has the disadvantage that the element is heavy and expensive. While the plastic deformation using type has the advantage that it is easy and inexpensive, this type lies however regarding the energy absorbing characteristics more badly than the cylinder type.

SUMMARY OF THE INVENTION

The plastic deformation using shock absorbers is inexpensive and fulfilled by small weight and requirements so up-to-date regarding reduction of costs of the vehicle production. It is thus a goal of the invention of making a shock absorber available, which works with plastic deformation, which is stable regarding the energy absorbing characteristic and from small weight and mechanically simply and inexpensive is to be manufactured. When we have a shock absorber developed result, which is installed between a bumper or - buffers and a framework of a motor vehicle and going by works, to transform on the buffer or bumpers exercised impact or Impaktenergie into deformation energy whereby the energy is absorbed. This shock absorber is characterised by the fact that it consists of a gradated pipe with many diameters, which consists of different diameter parts, which are formed by the fact that partly a straight pipe, which can be deformed plastic, partially reduced or partially is increased.

Each of these tubing parts with different diameters is connected by stages with the other one, which is formed between each edge of each tubing part of different diameter. An end of the gradated multiple diameter pipe is connected in each case with the buffer, the other end of the gradated multiple pipe with the framework of the vehicle. With this shock absorber the buffer or bumper is normally held at the vehicle frame as an element, which supports the buffer or bumper.

The shock absorber of the available invention is in such a way laid out that it absorbs impact energy with proceeding, so that the tubing part with small outside diameter is pushed into the tubing part with large outside diameter.

A part of the impact energy compresses the tubing parts. The impact energy is however usually used as plastic deformation of the stage, which is in-dragged, in as much as the tubing part with the small outside diameter is pushed into the tubing part with the large outside diameter. In this way energy is absorbed.

The gradated pipe with multiple diameter is developed as follows:

a) The gradations between the edge of the tubing parts are folded back against each of the tubing parts and
b) Tubing parts are connected by the gradation, so that the inside diameter tubing part than the outside diameter of the other one becomes larger.

The shock absorber covers concretely after the available invention:

a) the stage already began to be plastic deformed. Therefore the energy initially necessary for the plastic deformation can be small. Thus the Einwaertsbewegung of the gradation, which is dragged, walks gently forward.

With (B) telescopes the neighbouring pipes easily.

Thus the plastic deformation of the gradation progresses well. Thus the inside diameter of the tubing part with the small outside diameter is larger than the outside diameter of the other one that means that those is larger width W of the gradation than the wall thickness t of the tubing part with the larger outside diameter. Preferred the dimensions of the tubing parts, which are connected by the gradation, fulfill roughly the following relations:
$T1 > t2$ and $W > t2$,
whereby T1 is the wall thickness of the tubing part with the small outside diameter and t2 the wall thickness of the tubing part with the large outside diameter and W the width of the gradation, which connects both tubing parts. It is accepted that the tubing parts with the small and large outside diameters have lengths H1 and/or H2.

The shock absorber of the available invention covers concretely: (1) the shock absorber, with which the pipe with the gradated diameter is a gradated pipe with two diameters and which for pipe with the gradated two diameters a tubing part with large outside diameter and a tubing part with small outside diameter form, which is circular both and it will receive by partly reducing or increasing a straight pipe, which can be deformed plastic, whereby each edge or each edge of the tubing parts of different diameter is connected by stage sections, thus an axle of the pipes of different diameter on essentially straight aligned part and the tubing part with the large outside diameter intended and fastened is on the impact taking up part of the framework of the vehicle and

(2) the shock absorber, with which the gradated pipe with multiple diameter is a gradated three-diameter pipe and which forms gradated multiple diameter pipe a tubing part with small outside diameter, a tubing part with middle outside diameter and a tubing part with large outside diameter, which is essentially circular and will receive, by partly reducing a straight pipe or partly increases and/or expand, which can be deformed plastic, whereby by tubing parts of different diameter it is connected to each edge by gradations, with it an axle by tubing parts of different in each case diameter on straight lines is essentially positioned and the tubing parts of different diameters are arranged by diameter sizes in an order and the tubing part with large outside diameter intended and fastened is on the impact taking up part the framework of the vehicle.

Although the shock absorber prefers a gradated construction with multiple diameter after the available invention is, substantial restrictions are given regarding the number of stages due to the area for the installation the available. The gradated three-diameter pipe is a realistic construction, which concerns the number of working on steps. A shock absorber, which consists for example of a gradated pipe with three diameters, can be received easily as follows: On a normal round metal tube (a circular straight pipe) a given length of an end of the pipe in the diameter is expand and the other end in the diameter is reduced. With the gradated three-diameter pipe the tubing part with middle outside diameter suppresses an inclination or dumps of the tubing part with small outside diameter. The tubing parts with small and middle diameter in each case can be pushed together into the tubing part with larger diameter.

It is accepted that the shock absorber exhibiting the gradated pipe with three diameters has a length H and a wall thickness T1, whereby the tubing part with the middle outside diameter has a length of H2 and a wall thickness t2 the tubing part with the large outside diameter over a length H3 and a wall thickness T3 ordered and those has the tubing parts with the small and middle

outside diameter connected stage ordered width a W1 and the stage connecting the tubing parts with middle and large outside diameter over width a W2. The relations T1 > t2 > T3, W1 > t2 and W2 > T3 is kept. As mentions before, a normal round metal tube is partly expand and in the diameter reduced, in order to form a gradated pipe with three diameters, the wall thickness becomes T1 of the tubing part with the small outside diameter, which will receive, as the diameter is reduced, inevitably more largely than the wall thickness t2 of the tubing part with the middle outside diameter. Also the wall thickness T3 of the tubing part with the large outside diameter, received by expand of the diameter, is inevitable-proves smaller than the wall thickness t2 of the tubing part with the middle outside diameter. A metal tube is exposed to two plastic processing steps, i.e. the enlargement of the diameter and the reduction of the diameter. As result a shock absorber, which consists of a desired gradated three-diameter pipe, can be manufactured.

SHORT DESCRIPTION OF THE DESIGNS

Fig. 1 is a vertical cut by a shock absorber, which consists according to invention of a gradated two-diameter pipe;

Fig. 2 is a cut along the line II the Fig. 1;

Fig. 3 is a cut along the line II-II the Fig. 1;

Fig. 4 is a vertical cut and shows the relationship between the degree of the impact absorption and the degree of the deformation of a gradated two-diameter pipe, if the impact is exercised on the shock absorber, if the change of the condition of the Fig. 1 goes out;

Fig. 5 is a vertical cut by a shock absorber, which consists according to invention of a gradated pipe with three diameters;

Fig. 6 is a vertical cut and shows a tubing part with middle outside diameter, which is pushed into a tubing part with large outside diameter, change from the condition of the Fig. 5;

Fig. 7 a vertical cut, with which the tubing part began with the small outside diameter, is outgoing into the tubing part with the large outside diameter to be pushed, change from the condition of the Fig. 6;

Fig. 8 is a vertical cut and shows that the impact energy was absorbed to the largest part;

Fig. 9 is a vertical cut and points, like the impact from a diagonal direction to the shock absorber, that its condition from that the Fig. 5 changed, one exercised;

Fig. 10 is a vertical cut of a shock absorber, as it is used in a sample shock absorber; and

Fig. 11 is a diagram and shows the results for the measurement of the energieabsorption of the sample shock absorber.

DESCRIPTION OF DETAIL OF THE INVENTION

As in Fig. 1 shown, covers a shock absorber of the available invention a gradated pipe with pipe with two diameters, which is installed between a buffer or a bumper 2 and a framework 1 of a vehicle. The gradated pipe 9 with the two diameters transforms impact energy into deformation energy and absorbs so the energy. The gradated pipe 9 with the two diameters consists of a tubing part 3 with large outside diameter and a tubing part 4 with small outside diameter. Both tubing parts of 3 and 4 are essentially circular in the cross section. The edges of both tubing parts of 3 and 4 are connected, in such a manner by a gradation 5 that the axles of the tubing parts of 3 and 4 are essentially aligned. The tubing part with the large diameter 3 is fastened to a side of a vehicle frame 1, which takes up the impact. At the stage 5 the edges of both tubing parts of 3 and

4 in longitudinal direction of the gradated pipe with two diameters overlap themselves each other and on the tubing parts of 3 and 4 are back-folded.

The gradated pipe 9 with two diameters is manufactured as follows. A straight pipe is manufactured as tubing part of 3 with large outside diameter. A part of this straight pipe is tossed to reduce over cross-section area and forms so the tubing part of 4 with small outside diameter. The backfolded gradation 5 can be easily formed, if it is pressed in longitudinal direction of the gradated pipe 9 with the two diameter parts.

In order to cause this, the pipe with the two diameters and fastens against the taking up push-hurries the framework a bearing flange 6 with several pin holes 10, which is welded at the tubing part of 3 with large outside diameter, supplies. The diameter of the tubing throughholes 12, which are trained in the tubing storage seat 11 of the motor vehicle framework 1, is stopped smaller than the outside diameter of the tubing part of 3 with large diameter. Although this tubing part of 3 with large outside diameter, which is pushed in, is gecheckt, the tubing part of 4 with small outside diameter can be pushed in, whereby the gradation 5 is in-dragged. The gradated pipe 9 with the two diameters and the bumper or buffer 2 together by welding a storage pipe 7 attached, which is vertical, toward the end of the tubing part of 4 with small outside diameter, whereby pins 8 into the pin holes 13 in the pipe 7 and the bumper or buffer 2 are inserted and the pins, like into the Fig. 1 and 3 to be shown, fastened.

With the shock absorber after the available invention, if an impact is exercised on the bumper 2, the gradation becomes 5 inward against the tubing part 3 with large outside diameter, like in Fig. 4 shown and dragged. After Fig. the size of the impact energy is indicated to 1 and 4 by the arrow in thick execution within the gradated pipe 9 as the two diameters. The deformation energy is indicated as the size of the plastic deformation and designated by with the thin external line outside of the gradated two-diameter pipe the 9 < given arrow representation >. Before in Fig. 4 represented condition, the impact energy is reached in practice was nearly completely absorbed. For reasons of the appropriate explanation the arrow in thick outer contour was left.

If the tubing part of 3 with the large outside diameter is left as straight pipe and if a round metal tube in the diameter is reduced, in order to form the tubing part of 4 with the small outside diameter, this tubing part 4 has a large wall thickness with desirable results. In this case the tubing part with the large outside diameter 3 and the tubing part of 4 with the small outside diameter are essentially circular in the cross section. Their axles are essentially aligned. The energy absorption efficiency is high. Stable energy absorption characteristics are lent to the shock absorber. The relationship between load, which points arranged that the gradation is in-twisted, to the size of the movement of the buffer or shock absorber square wave characteristics. The tubing part of 4 with the small outside diameter must be firm and/or solid.

Another shock absorber after the available invention is in Fig. 5 shown and a round metal tube of essentially circular cross section covers 5. A length H1 of this pipe is reduced at an end in the diameter, in order to form a tubing part of 4 of small outside diameter. A length H3 of the other end is increased in the diameter and forms a diameter part of 3 large outside diameter. The remaining length H2 of the round metal tube like it is left and forms a tubing part of 15 of middle outside diameter. The neighbouring pipes are connected in each case by stages 5. The axles of the tubing parts of 3, 4 and 15 are essentially in such a manner aligned that the plastic deformations at the stages 5 are alike in circumferential direction. After the available execution form the stages 5 are appropriate for gradated three-diameter in one level perpendicularly to the longitudinal direction of the comprehensive pipe. The description of the procedure for installing this shock absorber at a vehicle is omitted here. In the available execution form the vehicle frame 1 is not provided with holes for the execution of the tubing parts, in order to prevent that the tubing parts of 4 and/or. 15 with the small and middle outside diameter to be prevented to be pushed in. For example however a hole can be intended that the execution of the tubing part becomes possible 14 with only the small outside diameter.

Under in Fig. 5 condition shown impact is exercised on the bumper 2, then the impact is transferred to the tubing parts of 3 and 15 with the middle and large outside diameter over the stages 5 as well as to the tubing part of 4 with the small outside diameter. The tubing part of 4 with the small outside diameter begins to be deformed in such a manner that it is pressed into the tubing part of 15 with the middle outside diameter and this middle tubing part of 15 pressed with the middle diameter into the tubing part 3 with the large outside diameter. After Fig. the size of the impact or Impaktenergie is indicated to 5-8 by a strongly taken off arrow within the gradated pipe 14 as the three diameters. The deformation energy is indicated designated by the size of the plastic deformation (the size of the Einwaertsbewegung) and by the thin arrow external line outside of the gradated pipe as the three diameters. In practice the impact energy must be nearly completely absorbed, before in Fig. 8 condition shown is reached. For reasons of the appropriate explanation however the arrow with the strong external line is left. The gradations 5 are plastic deformed and drawn in. This is realized by the fact that the pushed tubing part (i.e. the tubing part of 3 with the large outside diameter) is carried forward together with the stages 5, instead of the pushing pipe (for example the tubing part of 15 with the middle outside diameter). In the available three-diameter gradation pipe the thickness T1 of the tubing part of 4 compared with the small outside diameter with the thickness t2 of the tubing part of 15 with the middle outside diameter of the straight pipe is more largely. Turned around the wall thickness T3 of the pipe 3 with the larger outside diameter the smallest. The width W1 of the stage 5 between the tubing part 4 with the small outside diameter and the tubing part of 15 with the larger outside diameter is larger than the thickness t2. The width W2 of the stage 5 between the tubing part 3 with the large outside diameter and the tubing part of 15 with the middle outside diameter is more largely than the thickness T3 therefore becomes the plastic deformation of the stage, which arises, if the taking along begins inward, while the tubing part 15 begins with the middle outside diameter, into the tubing part 3 with the large outside diameter to be pushed, as in Fig. 6 represented. The plastic deformation of the stage, which occurs then, is as in Fig. 6 shown.

In this way the impact energy becomes first as Einwaertsbewegung of the tubing parts 4 and/or. 15 with the small and middle outside diameter absorbs. I.e., the impact energy absorbed as energy, which deforms or pulls the stage in 5, which between the diameter parts 3 and/or. 15 with the middle and large outside diameter is present. In similar way the impact energy is used as deformation energy, which pushes the tubing part 4 with the small outside diameter into the tubing part 15 with the middle outside diameter. Thus becomes, as in Fig. 6 shown, the stage 5 between the tubing part 4 with the small outside diameter and the tubing part of 15 with the middle outside diameter slightly pulled in or dragged.

The presence of the vehicle frame according to invention limits the Einwaertsbewegung of the stage, which is pulled in, whereby the stage 5 between the tubing part 3 with the middle diameter and the tubing part of 15 with the large outside diameter, like in Fig. 6 shown, positioned is. Then begins, as in Fig. 7 shown impact energy as energy to be absorbed which deforms or inward draws the stage, which between the tubing part 4 with the small outside diameter and the tubing part of 15 with the middle outside diameter is positioned. If the impact energy is further present, the Einwaertsbewegung of the stage becomes 5, which progresses between the tubing part of 4 with the small outside diameter and the tubing part of 15 with the middle outside diameter, until the movement by the vehicle frame 1 as in Fig. 8 one shows, one limits. Both stages 5 are pulled in in way described above. I.e. the impact energy is transformed into deformation energy. In this way the impact energy is mainly absorbed. The impact energy transferred to the vehicle frame 1 can be nearly completely waived and/or compensated.

Still further to prefer is it, if the shock absorber covers a stage pipe 14 with three diameters with three or more stages with different outside diameter parts after the available invention. This is demonstrated clearly particularly, where an impact under an angle on the bumper or buffer 2 is exercised. Fig. 9 is a vertical cut and shows, how an impact under an angle is exercised on the shock absorber, to the condition of the Fig. 5 and the grade of deformation of the gradated pipe

14 with the three diameters is reached. As mentions above, the wall thickness of the three tubing parts of 3, 4 and 15 of the different outside diameters are connected by the relations: T1 > t2 > T3.

Which concerns the stages 5, then the relations W1 applies > for t2 and W2 > T3.

Additionally the relationship between the lengths of the tubing parts associated with the degree, as easily they are tilted. After the execution form according to invention the length H1 of the tubing part of 4 larger with the small outside diameter than the length H2 of the tubing part of 15 with the middle outside diameter is. The length H2 of the tubing part of 15 with the middle outside diameter is nearly equal the length H3 of the tubing part of 3 with the large outside diameter. If an impact is thus exercised diagonally on the buffer 2, then the tubing part 4 with the small outside diameter, while the stage 5 is slightly inward drawn, tilts as in Fig. 9 represented. The tubing part of 15 with the middle outside diameter carries the tubing part of 4 with the large outside diameter and is plastic deformed, so that it is pushed into the tubing part of 3 with the large outside diameter. In this way impact energy can be absorbed.

In this way the successive tubing parts limit their mutual tilting motions with the shock absorber with the gradated three-diameter pipe. Finally the directions of the plastic deformations are identical, i.e. the tubing part of 15 with middle diameter is pressed into the tubing part of 3 with the large outside diameter. Thus the impact energy can be absorbed homogeneously independently of the direction of the applied impact. The size of the absorbable impact lies in relation to the whole of the Einwaertsbewegungen of the stages, which are inward drawn. The size of the Einwaertsbewegung of each stage, which is pulled in, certainly tubing parts pushed by the length the shorter pushing and. The tubing parts have preferentially same length. After the execution form specified above is H2 = H3. Also concerning the length H1 of the tubing part with the large outside diameter is this length equal to the length of the other one of the tubing parts, if an edge or a frontier is neglected for mounting at the buffer. Roughly applies thus: H1 = H2 = H3.

The energieabsorption a three-diameter pipe gradated by a multiplicity of shock absorbers, ever consisted of, was measured. The shock absorbers covered a shock absorber sample, their outline in Fig. 10 shown is. This absorber has a circular straight pipe from steel with a diameter of 50.8 mm. The tubing part with the small outside diameter has a length H1 of 45.0 mm and a wall thickness T1 of 2.95 mm an outside diameter Phi1 of 34.8 mm. The tubing part with the middle outside diameter has a length H2 of 50.0 mm and a wall thickness t2 of 2.30 mm an outside diameter Phi2 of 50.8 mm. The tubing part with the large outside diameter has a length H3 of 50.0 mm and a wall thickness T3 of 2.00 mm an outside diameter Phi 3 of 66.0 mm. In this way a gradated three-diameter pipe is formed. As evident from the managing description, it follows that W1 = 8.0 is mm and W2 = 7.6 mm. A length of 5 mm for each stage is back-folded against the appropriate pipe.

These measurements were accomplished in that way which can be described now. A load was applied on the pipe with the small outside diameter. Each pipe was pushed in. The relationship of the size of the absorbed energy with the size of the Einwaertsbewegung (i.e. the size of the deformation of the buffer in mm) measured as module load (kN). The results of the measurements are in the diagram of the Fig. 11 indicated. With the shock absorber regarded as samples the stages were formed by separate process steps. A large module load was necessary, until the stages were structurally deformed first, i.e., if the module load reached 13 mm. With the shock absorber after the available invention the plastic deformation became each stage, which fell along the module load mentioned and then the plastic deformation became observed, where the module load amounted to 13 mm or more. Its characteristic energy absorption curve resembles a square wave. Thus it can be stated that, are the stages before in such a way prepared that they can be deformed plastic, then has the shock absorber after the invention a characteristic energy absorption curve, which resembles a square wave.

The vehicle shock absorber after the invention supplies the following advantages.
1. The characteristic energy absorption curve takes the form of a square wave, i.e. the size of the absorbed energy increases rapidly. Directly after the speed, with which the energy is absorbed, is kept constant. Thus the energy absorption efficiency is high.
2. The multi-diameter stage pipe has pipes, which, arranged according to outside diameter, are arranged. This pipe creates easily a firmness, which carries a buffer. A cross section according to the distribution of the bending moments is received.
3. Since the stages, which are plastic deformed, on which outer circumferences at the edge of the tubing parts are present, a stable plastic deformation can be kept fast.
4. Since the load transferred to a console or such a thing, against which the shock absorber is stored, is kompressiv, is after their nature the firmness stably.
5. A metal tube can be formed easily into the desired forms, as the diameter is formed by means of hammers, die forging, presses or in another procedure. Final products of stable shape can be manufactured fast.
6. The reduced pipe has a large wall thickness. The increased pipe has a reduced wall thickness. The relationship between the sizes of these pipes is suitable, in order to be suitable for an effective production with plastic deformation.
7. The well-known double tube shock absorber after the conditions of the technology needed a high positioning accuracy between the pipes, a lubrication, dust proofness and a construction, in order to place a rigid stop surely. Contrary to well-known constructions the shock absorber does not need of these demands after the invention. Thus the shock absorber is superior after the invention regarding weight, costs and reliability of the well-known construction.
8. The size of the plastic deformation can be increased, as the number of stages in the gradated multi-diameter pipe is increased. Thus the size of the absorbed energy can be easily increased.

Claims OF **DE10042221**

1. Shock absorber for a vehicle, stored between the buffer or shock absorbers and the framework to transform in order impakt or impact energy, with which the buffer is subjected, into deformation energy and to absorb thereby the energy, whereby the shock absorber is a gradated pipe with multiple diameter; this gradated pipe with multiple diameter from tubing parts of different Duchmesser exists, which are formed, by partly a straight pipe, which can be deformed plastic, is reduced or partly expand; each of these tubing parts with different diameter is connected with stages, which are formed between the edge of each tubing part of different diameter, whereby an end of this gradated multi-diameter pipe is connected with this buffer or bumper and the other end of this gradated pipe is connected with multiple diameter with the framework of the motor vehicle.

2. Shock absorber according to requirement 1, whereby the stages of each of these tubing parts formed between the edge of the tubing parts with different diameter are back-folded.

3. Shock absorber according to requirement 1, whereby with tubing parts of different diameter of the inside diameters of the tubing part with large outside diameter, connected by the stages, in relation to the outside diameter of the tubing parts with small outside diameter is large.

4. Shock absorber according to requirement 1, whereby this gradated pipe with multiple diameter is a gradated pipe with two diameters, this gradated pipe with two diameters a tubing part with large outside diameter and a tubing part with small outside diameter forms, which is essentially circular and will receive, by partly a straight pipe, which can be deformed plastic, is reduced or expand, each edge of the tubing parts of different diameter by stages is connected, with it the axles of each pipe of different diameter is essentially one on the other aligned and this tubing part of large outside diameter on the impact or impakt taking up part of the framework of the motor vehicle intended and fastened is.

5. Shock absorber according to requirement 1, whereby this gradated multi-diameter pipe is a gradated pipe with three diameters, this gradated pipe with multiple diameters a tubing part with small outside diameter, a tubing part with middle outside diameter and a tubing part with large

outside diameter forms, which is essentially circular and will receive, as a straight pipe is partly reduced or expand, which can be deformed plastic, each edge of the tubing parts of different diameter is connected by stages, so that axles of each of the tubing parts of different diameter are essentially one on the other aligned, these tubing parts of different diameter in the order of the diameter size are arranged and this tubing part of large outside diameter intended and fastened is on the impakt or impact taking up part frameworks of the vehicle.